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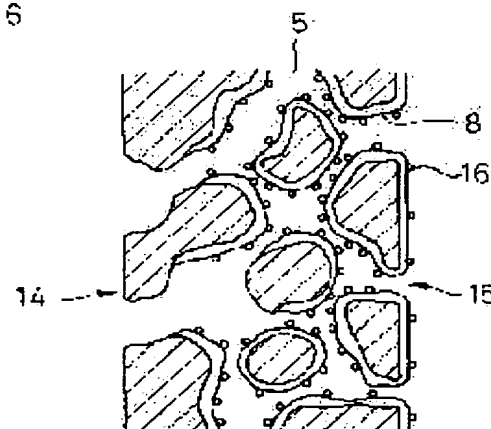
(54) FILTER FOR CLEANING EXHAUST GAS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a wall-flow type filter for cleaning exhaust gas which can burn and remove particulates in the pores in a partition wall.

SOLUTION: The wall-flow type filter for cleaning exhaust gas has many cells formed in the exhaust gas flow direction. The cells are plugged alternately at the exhaust gas inlet end. The cells plugged at the inlet end are opened at the exhaust gas outlet end, and the cells opened at the inlet end are plugged at the outlet end. Pores having an average diameter of 25-40 μm are formed in the partition wall between the cells, and a catalyst (16) is carried in the pores.

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CLAIMS

[Claim(s)]

[Claim 1] The cel by which it has the cel of a large number formed in the exhaust air flow direction, plug stuffing of the cel is carried out every other piece in the exhaust gas inlet-port edge, and plug stuffing is carried out at the inlet-port edge of a parenthesis is opened at the exhaust gas outlet edge. In the filter for the Wall flow mold emission gas purification with which plug stuffing of the cel in which the inlet-port edge is opened is carried out at the outlet edge The filter for the Wall flow mold emission gas purification characterized by forming pore with a pitch diameter of 25-40 micrometers in the interior of the septum between said cels, and supporting the catalyst in this pore.

[Claim 2] The filter for the Wall flow mold emission gas purification according to claim 1 characterized by making the coat layer for catalyst support form in the front face in said pore.

[Claim 3] The filter for the Wall flow mold emission gas purification according to claim 1 or 2 characterized by making the NOx absorber which emits the NOx component absorbed in the form of NO2 beyond predetermined temperature support in said pore.

[Claim 4] The filter for the Wall flow mold emission gas purification according to claim 1 or 2 characterized by making the inside of the pore of the exhaust gas entrance side of the thickness direction of said septum, or the septum front face of the cel of an exhaust gas entrance side cover HC adsorption material which emits HC to which it stuck beyond predetermined temperature.

[Claim 5] The filter for the Wall flow mold emission gas purification according to claim 1 or 2 characterized by making the septum front face of the cel of an exhaust gas outlet side support an oxidation catalyst.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] This invention relates to the filter for emission gas purification. If it states in more detail, in the filter for the Wall flow mold emission gas purification which carries out uptake of the party curate contained in exhaust gas, such as a diesel power plant, and processes it, this invention makes the pore front face inside the septum support a catalyst, and relates to the filter for the Wall flow mold emission gas purification from which it burns and a party curate is removed inside pore.

[0002]

[Description of the Prior Art] In the environmental pollution by diesel exhaust gas, NO_x and a party curate pose a problem. This party curate is the kind of the particle-like matter, and it mainly consists of a solid-state-like carbon particle (SOOT) and organic solvent extractives (SOF). Generally as a processing means of this party curate, the Wall flow mold filter 1 as shown in drawing 1 is used now. The cel 4 which the cel 3 to which plug stuffing is given to with the plug 2 by turns in one side of the ends of many cels (breakthrough), and plug stuffing of this filter is carried out in the inlet-port edge of exhaust gas is opened at an outlet edge, and is opened by reverse at the inlet-port edge has the structure by which plug stuffing is carried out at the outlet edge. and this pore of extent which obtains a next door meeting mutually, and a party curate cannot pass although exhaust gas can be passed to the septum 5 of a cel exists (for example, patent reference 1 reference).

[0003] If exhaust gas flows into the filter of such structure, as shown in drawing 1 B, in order that the exhaust gas 6 which flowed into the cel 4 of the exhaust gas entrance side by which the inlet-port edge is opened may surely pass a septum 5, uptake of the party curate will be carried out on the septum of the cel of this exhaust gas entrance side. The party curate by which uptake was carried out is removed by carrying out self-combustion according to an operation of the catalyst which carried out firing combustion with heater heating etc. or which the filter was made to support.

[0004] It was the structure where the filter for emission gas purification which carries out self-combustion formed the coat layer 8 on the inner surface of the cel of the body 7 of a filter conventionally as shown in drawing 2, and the catalyst 9 was made to support on the coat layer 8 according to an operation of the catalyst which made the filter support a party curate (for example, patent reference 2 reference). Moreover, like a publication in the patent reference 1, only the septum front face of the cel of an exhaust gas entrance side is made to support a catalyst, and the thing it was made not to make a catalyst support is also shown in the septum front face of the cel of an exhaust gas outlet side.

[0005]

[Patent reference 1] JP,59-211708,A (the 1-3rd page, drawing 1, drawing 3)

[Patent reference 2] JP,1-318715,A (the 1-3rd page)

[0006]

[Problem(s) to be Solved by the Invention] However, although a party curate is burned by the catalysis and processed in the septum front face of a cel with this proposed filter, on this front face, it is easy to emit the heat of combustion of a party curate, and the continuity of combustion is bad. Therefore, rather than the party curate removed by combustion, there will be more party curates which flow into a cel, and it will deposit on a septum front face after all. This deposited party curate cannot contact a catalyst, but the clearance by the catalysis is impossible. Thus, when a party curate accumulates gradually, passage of the septum of exhaust gas will also be checked, the pressure loss of a filter will increase, and it will become activity impossible. Moreover, the catalysis of the amount of catalysts was not fully therefore satisfactory only by making a catalyst support only on the surface of a septum, either.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned trouble, according to the 1st invention, it has the cel of a large number formed in the exhaust air flow direction. The cel by which plug stuffing of the cel is carried out every other piece in the exhaust gas inlet-port edge, and plug stuffing is carried out at the inlet-port edge of a parenthesis is opened at the exhaust gas outlet edge. In the filter for the Wall flow mold emission gas purification with which plug stuffing of the cel in which the inlet-port edge is opened is carried out at the outlet edge, pore with a pitch diameter of 25-40 micrometers is formed in the interior of the septum between said cels, and the catalyst is supported in this pore.

[0008] Moreover, in order to solve the above-mentioned trouble, the coat layer for catalyst support is made to form in the front face in pore in the 1st invention in the 2nd invention.

[0009] Moreover, in order to solve the above-mentioned trouble, the NO_x absorber which emits the NO_x component absorbed in the form of NO₂ beyond predetermined temperature is made to support with the 3rd invention in said pore in the 1st or the 2nd invention.

[0010] Moreover, in order to solve the above-mentioned trouble, the inside of the pore of the exhaust gas entrance side of the thickness direction of said septum or the septum front face of the cel of an exhaust gas entrance side is made to cover with the 4th invention HC adsorption material which emits HC to which it stuck beyond predetermined temperature in the 1st or the 2nd invention.

[0011] Moreover, in order to solve the above-mentioned trouble, the septum front face of the cel of an exhaust gas outlet side is made to support an oxidation catalyst with the 5th invention in the 1st or the 2nd invention.

[0012] The catalyst is supported with the 1st invention by the pore internal surface in the septum of a filter, and the party curate which flowed in pore reacts and burns on NO₂ and the catalyst in exhaust gas in pore in it. The charge of a filter material has low heat-conducting characteristic, and since the combustion field of a party curate is established in space which is called the inside of pore and which was blockaded mostly, the heat with which it was filled with heat of combustion in this pore, and filled in this pore promotes combustion of the further party curate. Thus, since the combustion efficiency of a party curate is high, before a party curate accumulates on the septum front face by the side of emission close [of a cel], since it flows in pore and combustion clearance is carried out one after another, a party curate does not have a problem of the pressure drop buildup by deposition of a party curate.

[0013] In the 2nd invention, the amount of catalyst support in pore can be increased by making the coat layer for the surface catalyst support in pore form.

[0014] In the 3rd invention, NO which does not contribute to combustion of a party curate at the time of low temperature, and NO₂ are absorbed by this NO_x absorber by making the NO_x absorber support. If temperature rises with combustion of a party curate in pore, this absorbed NO and NO₂ are emitted as NO₂, and a party curate and the probability to react become high and can improve the flammability of a party curate more. Moreover, the temperature up by combustion of a party curate stimulates NO₂, and it makes combustion of a party curate further accelerated by making a NO_x absorber support in the pore which is the combustion field of a party curate. Furthermore, change to NO₂ of NO generated by combustion can also be promoted by existence of a NO_x absorber.

[0015] In the 4th invention, HC adsorption material is adsorbed at the time of low temperature, and HC is emitted by the temperature rise by combustion of a party curate. In order that this emitted HC may burn according to an operation of the catalyst in pore and may raise the temperature in pore, it promotes combustion of a party curate. An adsorption bleedoff operation of HC according to the temperature change by combustion of a party curate can be made to perform by arranging HC adsorption material directly on a filter.

[0016] the coat layer for [in order to make a party curate flow in pore] catalyst support -- thin -- not carrying out -- it may not obtain, consequently the total amount of catalyst support may decrease, and the oxidation ability of HC may be insufficient In the 5th invention, this problem is solved by making the septum front face of the cel of the exhaust gas outlet side of a septum support an oxidation catalyst. Furthermore, although it deposits in the pore of an exhaust gas outlet side, since a party curate makes the septum front face of the cel of the outlet side of exhaust gas support an oxidation catalyst, it does not have decline in the contact probability of HC by deposition of a party curate, and an oxidation catalyst, and can maintain the activity of a catalyst with the heat transfer of the heat of combustion of a party curate.

[0017]

[Embodiment of the Invention] Hereafter, this invention is explained with reference to the accompanying drawing which shows the one example. The Wall flow mold exhaust gas filter of this invention is

manufactured as follows. First, the coat layer for catalyst support is formed in a filter using coating equipment as shown in drawing 3. In drawing 3 R> 3, 1 is the Wall flow mold filter, and they are pore volume 0.58 - 0.65 cc/g, and the pore pitch diameter of 25-35 micrometers. Cordierite was used. In this invention, as this Wall flow mold filter, hot exhaust gas [as / in an automobile etc.] can be filtered, for example, and what is used from the former which has the thermal resistance which bears this hot exhaust gas as an ingredient which forms this filter can be used. As the example, ceramics other than the above-mentioned cordierite, such as an alumina, silica, titania, zirconia, silica-alumina, and alumina-zirconia, an alumina-titania, a silica-titania, a silica-zirconia, a titania-zirconia, and a mullite, is mentioned.

[0018] The configuration and magnitude of this filter can prepare and use various things according to its application, the object, etc. The Wall flow mold filter has many cels in the negotiation direction of exhaust gas, and much minute pores which are extent which can pass exhaust gas as shown in drawing 4 exist in the septum between these cels. With the Wall flow mold filter currently used conventionally, since the party curate was filtered in septum top 14 of the cel of an exhaust gas entrance side, pore was made into the magnitude which is extent which a party curate cannot pass. In this invention, a party curate is introduced in this pore and the combustion field of a party curate is offered within this pore. Therefore, magnitude of pore is made into the magnitude which is extent into which a party curate can flow. Since the mean diameter of a party curate is 10-30nm and the party curate is usually connected in the shape of a straight chain, it is desirable to make magnitude of pore larger than this, and specifically, it is 25-40 micrometers desirably. It is extent. Moreover, since pore is mutually connected through the thin path, even if the magnitude of pore is quite large, the trap of it is carried out at this path, and a septum is hardly passed. Furthermore, in order to put in more party curates in pore, it is large in the magnitude of the pore of the entrance side of exhaust gas, and it is more desirable to make small magnitude of the pore of the outlet side of exhaust gas.

[0019] In order to secure the pore of above sufficient magnitude, to form a coat layer thinly is needed. Therefore, formation of a coat layer is performed as follows. First, only in the exhaust gas outlet edge 10 of the Wall flow mold filter 1, plug stuffing is given to a cel by turns by the plug 2. And as shown in drawing 3, as the exhaust gas outlet edge 10 which gave this plug stuffing serves as the direction upside of a vertical, a filter is installed, and coating liquid 11 is slushed from the cel to which plug stuffing is not given among the exhaust gas outlet edges 10. As coating liquid 11, the alumina with a viscosity of 100cps or less was used. The solution of ceramics, such as a thing which has big surface area, which is generally used to catalyst support as this coating liquid in addition to this alumina and which is porosity, for example, silica, titania, and titania-alumina, and a titania-silica, can be used.

[0020] Since plug stuffing is not given to the exhaust gas inlet-port edge 12 of a cel, much coating liquid flows out of the lower part edge of a cel. However, as shown in drawing 5, by capillarity, the coating liquid 11 which flows and falls along with the septum of a cel permeates a septum 5 toward the exhaust gas entrance side 14 from the exhaust gas outlet side 15 of the thickness direction of a septum, and forms the bonnet coat layer 8 for the pore front face in a septum. What is necessary is just to make it coating liquid permeate in pore by capillarity by adjusting these conditions suitably anyway in formation of such a coat layer 8, although operation conditions change with the magnitude of the pore of a filter, the specific gravity of coating liquid, a solid-state content, viscosity, etc. However, it is so required that a coat layer bars passage of exhaust gas and trespass of a party curate is barred to make it not block pore. Moreover, as shown in drawing 3, in order to promote osmosis of coating liquid, coating liquid may be attracted from 13 using a pump (not shown).

[0021] Since coating liquid 11 is made to permeate a septum from the outlet side of exhaust gas and a coat layer is formed by using this coat approach, it is easy to make thickness of the coat layer of the pore of the exhaust gas outlet side in a septum thicker than the thickness of the coat layer of the pore of an exhaust gas entrance side, and it can perform easily making magnitude of the pore of the exhaust gas outlet side in a septum as a result smaller than the magnitude of the pore of an exhaust gas entrance side. That is, the inflow to the pore of a party curate can be made easy, and passage of a party curate can be prevented. Moreover, the whole pore can also be covered in a coat layer to homogeneity. Furthermore, since coating liquid is made to permeate from the exhaust gas outlet side of a septum and a coat layer is formed, it can prevent easily a coat layer blocking the pore of the exhaust gas entrance side in a septum.

[0022] In this way, after forming a coat layer, a filter 1 is removed from equipment and an exhaust gas outlet edge gives plug stuffing to the cel to which plug stuffing is not given in an exhaust gas inlet-port edge. Subsequently, desiccation and baking are performed with a conventional method.

[0023] In this way, if a catalyst is made to support after forming a coat layer on the front face of the pore in the septum of the Wall flow mold filter at homogeneity, a catalyst can be made to support on the front face

of pore. As a catalyst, the noble metals usually used, for example, platinum, palladium, a rhodium, etc. can be used. sinking into the slurry which can perform support of a catalyst with a conventional method, for example, includes a catalyst, and drying and calcinating -- be alike is carried out. In support of this catalyst, it is desirable to carry out by slushing a slurry including a catalyst from the exhaust gas inlet-port edge of the filter in which the above-mentioned coat layer was formed. It is because a catalyst will hardly be supported near an exhaust gas entrance side but those many will be supported in pore, when the slurry which the coat layer 8 is hardly formed in the exhaust gas entrance side 14 of a filter, therefore includes a catalyst from this exhaust gas entrance side 14 is made to permeate as shown in drawing 5.

[0024] If the coat layer for catalyst support is made into homogeneity into pore, homogeneity can be made to also support a catalyst in pore. Moreover, as by making [more] an exhaust gas outlet side than the exhaust gas entrance side in a septum shows this coat layer to drawing 6, the amount of support of a catalyst 16 can also be made [many] as a result in an exhaust gas outlet side rather than an exhaust gas entrance side. With such a filter, although lock out of a party curate is started in the part which the average pore diameter of an outlet side is small from that of an entrance side according to the difference of the amount of coats, and is small [a pore diameter], the ratio of a catalyst is high, and this part becomes usable [a filter] by repeating the partial blockade of a party curate, and combustion, maintaining the low voltage disadvantage condition before resulting in lock out.

[0025] In this way, after making a catalyst support, a NO_x absorber may be made to support on the coat layer in pore. If ***** becomes an elevated temperature about NO and NO₂ at the low temperature of 250 ** extent, a NO_x absorber can mean what emits NO₂ with a peak of 350 **, for example, alkali metal and alkaline earth metal can be used for it, and Na, its Li, etc. are [among these] desirable. although NO and NO₂ do not participate in combustion of a party curate in low temperature -- an elevated temperature -- for example, -- If it becomes 400 degrees C or more, combustion of the party curate on a filter as shown in the following type will become prosperous.

$\text{NO} + 1/2\text{O}_2 \rightarrow \text{NO}_2$
 $\text{NO}_2 + \text{C} \rightarrow \text{NO} + \text{CO}$ Or $\text{N} + \text{By}$ arranging a NO_x absorber in CO₂, therefore pore In the time of the elevated temperature to which NO₂ participates in combustion of a party curate, by the heat of combustion by combustion of the local party curate in pore, NO₂ is emitted to required timing and combustion of a party curate is promoted further.

[0026] Although HC is contained in exhaust gas, it is the bottom type HC by the catalysis. $+\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$, and it is known that the heat generated at the time of this HC combustion will use for combustion of a party curate. Then, if the coat of the HC adsorption material which emits HC is carried out to the inside of the pore of the exhaust gas entrance side of a septum, or the septum front face of a cel when HC is adsorbed in the low temperature at which a party curate does not burn and it becomes an elevated temperature, as shown in drawing 7 Desorption of HC currently adsorbed according to the temperature up by combustion of a party curate is promoted, and this HC from which it was desorbed will enter in pore, will burn [near the party curate], and will promote combustion of a party curate further. A zeolite, mordenite, SEPIRAITO, etc. are illustrated as this HC adsorption material. Moreover, it is for suppressing flowing out down-stream, without emitted HC burning, and making combustion within pore into a more positive thing to arrange this HC adsorption material not to the outlet side of pore but to the exhaust gas entrance side of pore.

[0027] The filter for emission gas purification of this invention introduces a party curate in pore, and burns a party curate within this pore. Therefore, it is required that the coat layer for catalyst support does not make pore blockade. For this reason, as compared with the conventional filter which a coat layer is formed [filter] on the front face of a septum, and makes a catalyst support, thickness of a coat layer must be made thin. For example, although the amount of coats is 65 g/l extent with the conventional filter, the amount of coats is 33 g/l at the invention in this application. It is extent. Thus, when there are few amounts of coats, the total amount of the catalyst made to support may decrease, HC in exhaust gas cannot be oxidized enough, but HC decontamination capacity may fall. In order to solve such a problem, it is desirable to make an oxidation catalyst support apart from the combustion field of a party curate.

[0028] However, if an oxidation catalyst is made to support, the problem that sulfate occurs will newly arise. However, since it is comparatively quick compared with oxidation of SO₂, by choosing appropriately SV (space velocity) of exhaust gas which passes a filter, oxidation of this HC can control generation of sulfate, and can enable clarification of HC. If only the die-length L which according to our experiment this space velocity is more than 150,000 / hr, therefore realizes this space velocity makes an oxidation catalyst support from the lower stream of a river of a filter, generation of the above-mentioned object, i.e., sulfate, can be controlled, and clarification of HC can be enabled.

[0029]

[Effect of the Invention] The catalyst is supported with the filter for emission gas purification of this invention by homogeneity on the front face of the pore in the septum of a filter, by burning a party curate and removing in this pore, a party curate can be processed efficiently and there is also almost no pressure drop buildup of the filter by deposition of a party curate.

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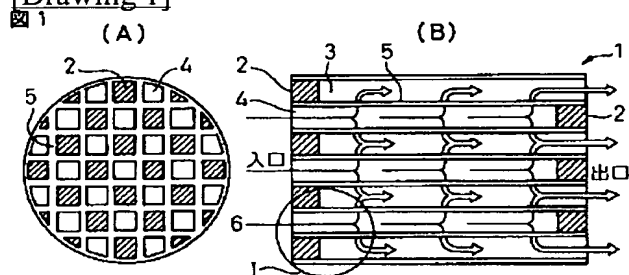
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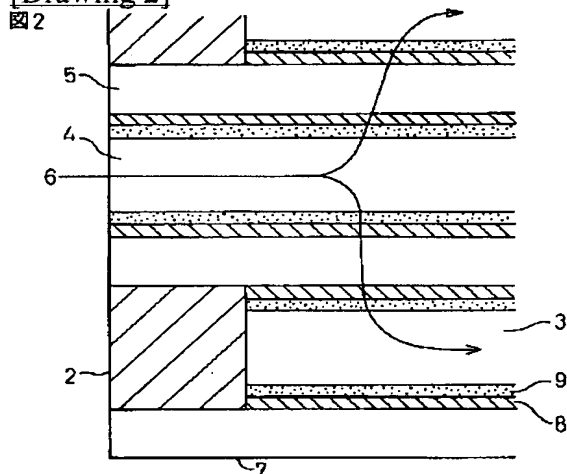
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DRAWINGS

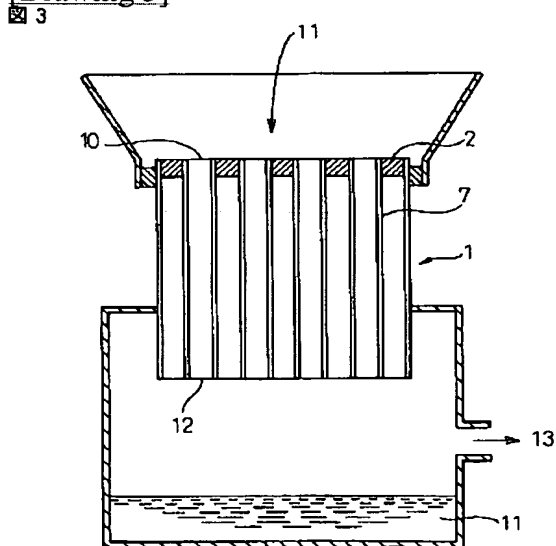
[Drawing 1]



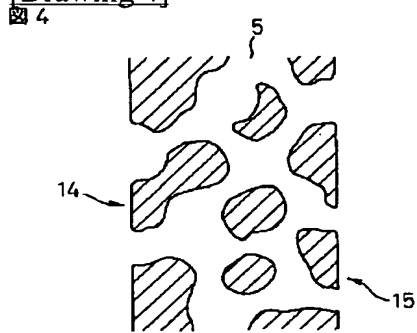
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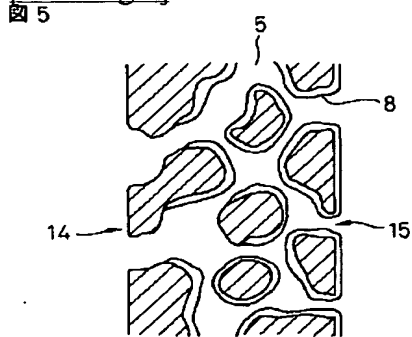
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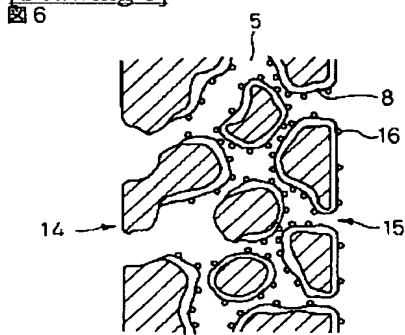
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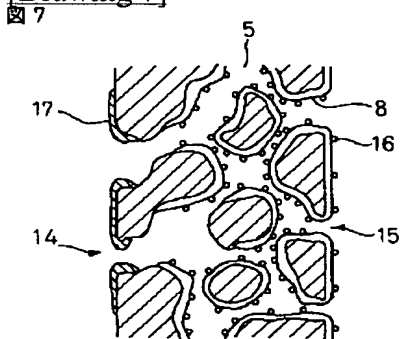
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]